

National Marine Fisheries Service  
Southwest Fisheries Science Center  
Santa Cruz Laboratory  
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Santa Cruz, California 95060

August 5, 2002      F/SWC3:KAB

## CRUISE REPORT

VESSEL:            NOAA R/V DAVID STARR JORDAN, DS 02-05

CRUISE DATES:    MAY 9- JUNE 11, 2002

PROJECT:           Rockfish Recruitment Assessment,  
                      Groundfish Analysis Team, SWFSC - Santa Cruz, CA

ITINERARY:        LEG I: May 9 - May 26.

The annual juvenile rockfish survey began in San Francisco on Thursday, May 9, 2002. The Ship along with embarked scientists departed Pier 30, San Francisco at 1200. Beginning the night of May 9 and ending the morning of May 26 the Ship and scientists conducted a juvenile rockfish survey between Cypress Point (Monterey County) and Point Reyes (Marin County). The survey completed the majority of 2 out of 3 planned sweeps of the sampling area. We disembarked Chief Scientist Steve Ralston on May 12 at Santa Cruz Harbor. The Ship had to replace a broken steering pump relay solenoid in San Francisco on May 17. We exchanged 3 scientists and a Ship's Officer in San Francisco on May 18. At the end of leg I the Ship pulled in to Pier 27 in San Francisco the morning of May 26. One day was spent in port on May 27.

LEG II: May 28 - June 10. Embarked scientists on May 28, and departed Pier 27 at 1400. The first 2 nights and days were spent finishing sweep 2. Continued with third sweep of juvenile rockfish survey beginning the night of May 30 until June 2. We completed the first 3 nights of mid-water trawling at the Inside Monterey Bay, Outside Monterey Bay, and Davenport transects. From the afternoon of June 2 until June 10 we were weathered out of operations. We anchored up at Half Moon Bay initially on June 2 and attempted the Pescadero trawling stations the night of June 3-4 to no avail. We transited to and tied up to Pier 27 in San Francisco on June 4. The Ship remained at Pier 27 until June 10 due to high seas. We were not able to complete the last 4 of the seven nighttime trawling operations. The lines not completed were; Pescadero, Outside Farallones, Pt Reyes, and Inside

Farallones. Beginning the morning of June 10 a Flatbed truck along with 2 pick-up trucks from the Santa Cruz Lab were used to transport equipment from Pier 27 and the Tiburon warehouse back to the Santa Cruz Lab. Ship departed San Francisco one day early (June 10) for San Diego.

#### OBJECTIVES:

1. To determine the distribution and abundance of pelagic juvenile rockfish between Cypress Pt. and Pt. Reyes, CA and their relationship with oceanographic conditions (temperature, salinity, currents, etc.).

2. To characterize prominent biological and physical oceanographic features.

3. To capture, process, and tag adult rockfish.

4. To collect juvenile salmon within the Gulf of the Farallones for genetic studies.

5. To observe seabird and marine mammal distribution and abundance between Cypress Pt. and Pt. Reyes, CA.

## METHODS:

### 1. Juvenile Rockfish Survey:

Three sweeps of the area were made. Five to seven midwater trawls of 15 minute duration were conducted each night along seven transects. A Stauffer-modified midwater trawl with an 86' headrope and 1/2" codend was used to obtain samples of juvenile rockfish. All fish, market squid, krill, and shrimp were identified and enumerated. Ship speed through the water was maintained at ca 2.0 kt while trawling. Trawling operations commenced at dusk and concluded at dawn. Target headrope depths were 7, 30 and 100 meters. The majority of the trawls targeted a headrope depth of 30 meters. A Vemco Minilog Temperature-Depth-Recorder was placed on the trawl net's headrope during each tow to record depth and temperature.

CTD casts were made throughout the day in the vicinity of the trawl transects and at each trawl station at night. The CTD was lowered to a maximum depth of 500 m, as bottom depth allowed. Deployment rate: held 2 minutes near the surface, then 45 m/min. Retrieval rate: 60 m/min. Water samples were periodically collected for fluorometer calibrations and nutrient analysis.

ADCP, EK500, thermosalinometer, and bench top fluorometer data recordings were made continuously during the juvenile rockfish survey.

Figure 1 illustrates the survey's standard trawl and CTD stations.

### 2. Acoustic/ADCP/Thermosalinometer/Fluorometer Recordings:

Acoustic data were collected continuously throughout the cruise using a Simrad EK500 multi-frequency echo sounder. The echo sounder was configured with down-looking 38, 120, and 200 kilohertz (kHz) transducers mounted in the hull. During the survey, the EK500 was configured to transmit pulses every 2 seconds at 1 kilowatt for 1 millisecond duration. Geographic positions were obtained from the ship's GPS and logged every 60 seconds. Ethernet communications were maintained between the EK500 and a Windows based PC which logged the EK500 telegrams using EchoLog software. Data were analyzed and displayed in the lab using Sonardata's EchoView software.

An RDI Acoustic Doppler Current Profiler recorded data continuously while underway to determine subsurface current velocity and direction. The hull mounted ADCP recorded horizontal and vertical velocity as a function of depth by using the Doppler effect to measure the radial relative velocity between the instrument and scatterers in the ocean. The CalCOFI UE4m.exe ADCP setup configuration was used to input navigational data from the Ship's GPS and gyrocompass into the ADCP Data Acquisition Software (DAS). The ADCP transmits a ping from its

transducer elements roughly once per second. Profiles were produced and displayed on a PC by range-gating the echo signal, which produces successive segments called depth bins. The noisy velocity estimates from each ping are vector averaged into ensembles which are subsequently saved to computer disk.

A permanently mounted Seabird thermosalinometer continuously recorded seawater temperature and salinity while underway. The thermosalinometer measures water that is continually pumped from a sea-chest located on the Ship's hull at a water depth of 3 meters. This data was used for comparisons with CTD casts and for estimating oceanographic frontal areas. All the thermosalinometer data was saved to computer disk.

A Turner Designs model 10AU fluorometer was configured to record raw chlorophyll data continuously while underway. The fluorometer was bench-mounted with a seawater flow-through system attached. The flow-through seawater was pumped through the Ship's hull at a depth of 3 meters. The chlorophyll data was combined with the Ship's GPS location data via the Ship's SCS and subsequently saved to computer disk.

### 3. Adult Rockfish Sampling:

In order to augment the concurrent Santa Cruz Lab Groundfish Ecology Cruise Program, we fished at 2 longline sampling stations in the vicinity off Davenport, CA. Conventional hook and line gear was used. Whenever weather and time permitted, we visited the inshore station where we attempted to catch previously tagged fish and we tagged additional specimens. At the deeper station, and for any fish at the inshore station which could not be tagged, we collected biological data.

All captured untagged adult groundfish were processed as follows:

- a. Each fish was weighed and measured
- b. A cut was made in the abdomen to determine sex and maturity.
- c. Ovaries were removed and preserved in formalin.
- d. Otoliths were removed and stored in coin envelopes.

### 4. Juvenile Salmon:

Midwater trawls were conducted at night. Concurrent with the juvenile rockfish catches, any juvenile salmon caught were collected and immediately frozen and kept at -80 degrees Celsius for future genetic studies.

### 5. Seabird and Marine Mammal Observations:

Ornithologists from PRBO Conservation Science (formerly Point Reyes Bird Observatory) were aboard during Leg I. Ornithologists from the National Park Service were aboard during Leg II. The ornithologists estimated the distribution and abundance of seabirds and marine mammals while underway. The

ornithologists used standardized population censusing techniques to survey the marine birds and marine mammals.

Observers censused birds continuously from the Ship's flying bridge during daylight hours while the vessel was underway at speeds of 7 knots (9 km /h) or greater. A range-finder was used to estimate the width of the survey transect and only those birds sighted within a 300 meter arc from the bow (directly ahead) to 90 ° off the side with best visibility (e.g., least glare) were logged into a field computer. Ship-following birds were recorded the first time they were detected and were ignored thereafter. The observers estimated the range to marine mammal sightings and recorded them, regardless of their perpendicular distance to the vessel.

## Results:

### 1. Juvenile Rockfish Survey:

A total of 85 midwater trawls were conducted at night during the three sweeps. In relation to the 19 year history of this project we observed relatively high catches of juvenile rockfish. Total number of juvenile rockfish caught is similar to the catches we had in the early 1990s. Even though we did not complete the third mid-water trawl sweep we still had the highest catches on record over the entire history of our surveys for 2 species of juvenile rockfish (widow and stripetail). We also saw the second highest abundances since these surveys began for 4 juvenile rockfish species (canary, blue, pygmy, black). Canary rockfish has been designated as an overfished species within the Federal Groundfish Management Plan. We captured the highest numbers of juvenile bocaccio rockfish since 1991. Bocaccio is also designated as an overfished species. The sizes of the juvenile rockfish were much higher than what was observed during the previous 8 years. These relatively high catches and larger sizes go against the trend of low abundance and sizes seen in our surveys during the years from 1994 - 2000 and may indicate a strong 2002 year class.

Marine scientists from the University of California at Santa Cruz also participated in the cruise in order to research the abundance and feeding behavior of market squid and to collaborate with the NMFS Santa Cruz Lab scientists on krill identification and abundance from the mid-water trawl operations. The number of young market squid caught in the midwater trawls was relatively high compared to previous cruises.

180 successful CTD casts were made during the three sweeps. Seawater was collected at depth during several CTD casts per day. Samples of seawater from the CTD casts were frozen for nutrient analysis and 200 ml of the water samples were filtered for

chlorophyll/fluorometer calibrations.

Anecdotal evidence from this cruise on the comparatively higher levels of surviving juvenile rockfish and young market squid give further evidence of a proposed climatic shift in ocean conditions between Washington State and California. This climatic shift appears to be favorable to growth and reproductive success of rockfish, similar to what was observed during the 1980's.

Table 1 lists the species of juvenile rockfish caught during each sweep of the cruise. Table 2 lists the total numbers of juvenile rockfish caught during the cruise and on previous similar cruises since 1986.

## 2. Biological and Physical Oceanographic Data Collections:

Contour charts of near surface seawater temperature, salinity, and chlorophyll will be produced and analyzed for subsequent publication. Strong alongshore, equatorward winds produced strong upwelling signals upon the continental shelf. Near-surface Chlorophyll levels showed much variability with strong pulses near the shelf break off Davenport, CA and Pescadero, CA.

Acoustic data were collected continuously and successfully throughout the cruise using the Simrad EK500. Approximately 4 gigabytes of data were collected during the cruise. The data are being used for various studies including: 1)acoustic target identification and differentiation, 2:)concordance of bird sightings with zooplankton prey fields.

## 3. Adult Rockfish Sampling:

Conventional hook and line fishing (rod and reel) was used successfully to obtain specimens. We used a variety of lures including shrimp fly rigs baited with squid to catch the adult rockfish. A total of 56 fish were caught (Table 3). The weather conditions prevented us from effectively fishing at our inshore longline station except on one occasion when we were able to tag and release two gopher rockfish. All of the other fish were caught at our 50 fathom shelf longline station. The catch of greenspotted rockfish were quite helpful to our ongoing groundfish ecology cruises, helping to fill in a temporal gap resulting from poor weather conditions in April and May. Surprisingly absent from our catches was the flag rockfish which has been quite abundant in our previous longline studies at the 50 fathom shelf station.

## 4. Juvenile salmon:

Four salmonids were collected from 4 midwater trawl hauls and frozen in the ultracold freezer.

## 5. Seabird and marine mammal observations.

During Sweeps 1 and 2 trained observers from PRBO Conservation Science (formerly Point Reyes Bird Observatory) used standardized population censusing techniques to survey the distribution and abundance of marine birds and cetaceans in the study area.

Seabird and cetacean surveys covered a study area extending northwards from Monterey Bay to Point Arena (300 km), and across the shelf and the slope (80 km). This area was surveyed during May 9 - 26, 2002. Overall, ~890 cetaceans and over 14,700 birds were recorded during 18 days and over 1900 km of survey effort. Sooty Shearwater (*Puffinus griseus*), Common Murre (*Uria aalge*), pacific white-sided dolphin (*Lagenorhynchus obliquidens*), humpback whale (*Megaptera novaeangliae*) and northern fur seals (*Callorhinus ursinus*) were the most numerous seabirds, cetaceans, and pinnipeds observed. Surveys revealed species assemblages associated with shelf (0 - 200 m depth), shelf-break (201 - 1000 m depth), slope (1001 - 2999 m depth) and pelagic ( $\geq 3000$  m depth) waters similar to the ones described during the previous year. Sooty Shearwaters (42% of all birds sighted), Common Murres (18%), Cassin's Auklet (16%), and Red/Red-necked Phalarope (*Phalaropus spp.*) (12%) were numerically-dominant seabirds found on the shelf. Sooty Shearwaters were also numerically dominant on the slope (70%) and pelagic (62%) regions. Data from sweeps 1 and 2 in both 2001 and 2002 are archived at PRBO.

During Sweep 3 observers working for the Pt. Reyes National Seashore used standardized population censusing techniques to survey the distribution and abundance of marine birds and cetaceans. A total of 21 species of seabirds were identified to species. Of the total number of birds counted (4855), 85.8% were sooty shearwaters (4168), 5.5% were western gulls (265), 3% were black-footed albatross (148), 3% were common murres (145), 0.5% were pink-footed shearwaters (26), 0.2% were rhinoceros auklets (9), 0.3% were Cassin's auklets (13), 0.2% were Brandt's cormorants, 0.4% were brown pelicans, two sightings of one each of tufted puffins, and single sightings of the following: herring gull, red-throated loon, northern fulmar, pigeon gullimot, south polar skua, and black storm petrel; several gull species (California gull, Herrman's gull, and herring gull) and two Laysan albatross.

Seven species of marine mammals were identified and of the total number of mammals counted (163), 71.2% were Pacific white-sided dolphins (116) and 16% were Dall's porpoise (26). We had 4 sightings of California sea lions (1 each), 3 sea otter sightings (1 each), 9 Rissos dolphins (two sightings of three each), 1 harbor seal, two unidentified whales, and two humpback whales.

DISPOSITION OF DATA:

1. Juvenile rockfish specimens, CTD, EK500, chlorophyll, thermosalinometer, ADCP, data and profiles - Keith Sakuma, NOAA NMFS, 110 Shaffer Road, Santa Cruz CA 94920

2. Juvenile salmon specimens and data - Bruce MacFarlane, NOAA NMFS, 110 Shaffer Road, Santa Cruz, CA 95060

3. Seabird and marine mammal data - (Sweeps 1 and 2) Bill Sydeman, Point Reyes Bird Observatory, 4990 Shoreline Hwy, Stinson Beach, CA 94970; (Sweep 3) Sarah Allen, Point Reyes National Seashore, 1 Bear Valley Road, Pt Reyes, Ca 94956.

SCIENTIFIC PERSONNEL:

Leg I (May 9 - May 26)

Steve Ralston, Res Fish Biol, NMFS-Santa Cruz, CA (Chief Sci)  
Ken Baltz, Oceanographer, NMFS-Santa Cruz, CA  
Keith Sakuma, Research Fish Biologist, NMFS-Santa Cruz, CA  
Don Pearson, Research Fish Biologist, NMFS-Santa Cruz, CA  
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Meredith Elliott, Ornithologist, PRBO, Stinson Beach, CA  
David Hyrenbach, Ornithologist, PRBO, Stinson Beach, CA

Leg II (May 28 - June 10)

Steve Ralston, Res Fish Biol, NMFS-Santa Cruz, CA (Chief Sci)  
Ken Baltz, Oceanographer, NMFS-Santa Cruz, CA  
Keith Sakuma, Research Fish Biologist, NMFS-Santa Cruz, CA  
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DATE: \_\_\_\_\_

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## Standard Trawl and CTD Station Locations

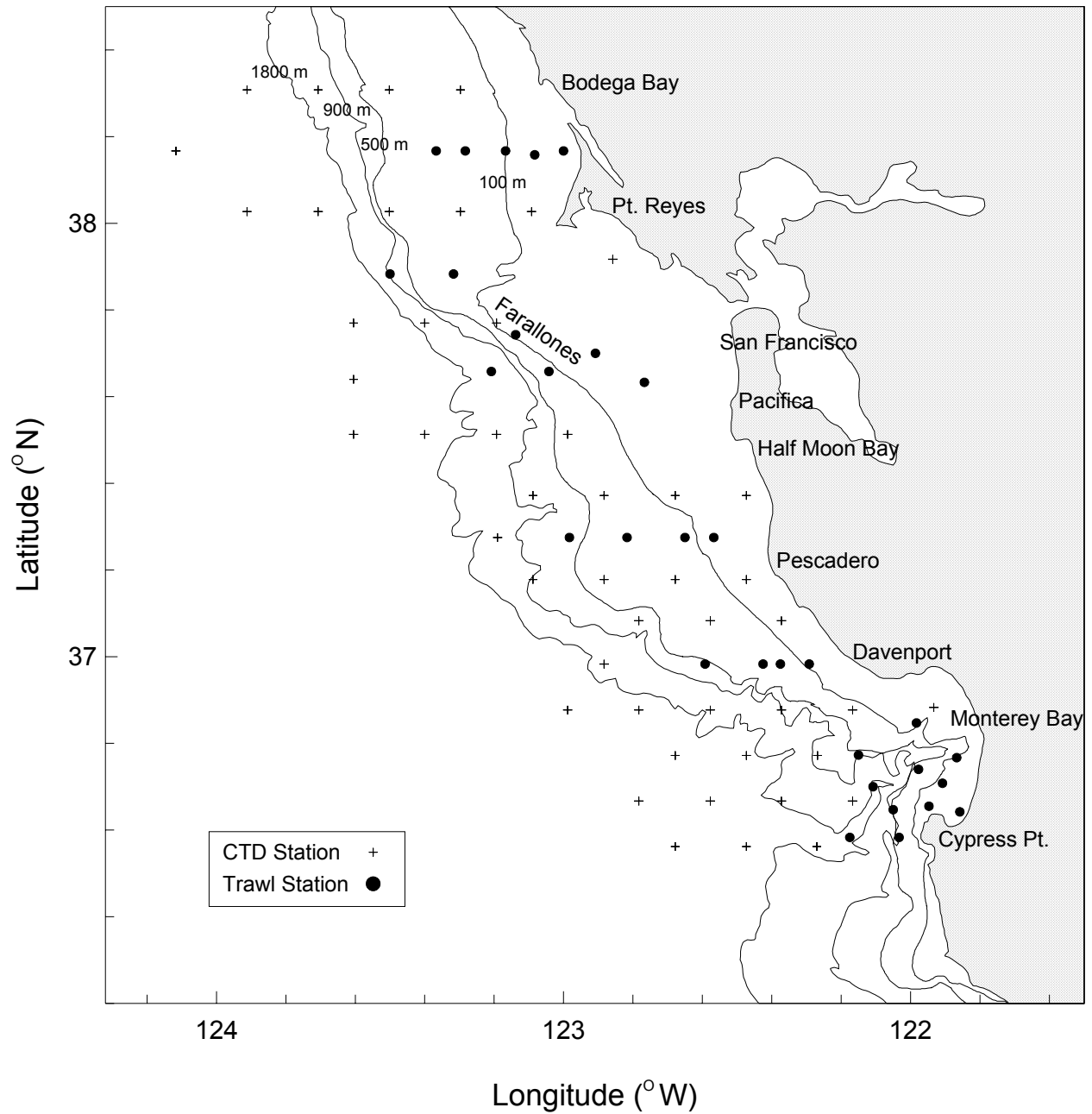


Figure 1. Standard Sampling Stations for the Juvenile Rockfish Survey

**Table 3. Counts of Adult Groundfish Caught by Hook and Line During the May/June 2002 Juvenile Rockfish Cruise**

| <b>COMMON NAME</b> | <b>TOTAL</b> | <b>COMMENTS</b> |
|--------------------|--------------|-----------------|
| BOCCACIO           | 2            |                 |
| CHILIPEPPER        | 1            |                 |
| COPPER             | 3            |                 |
| GOPHER             | 2            | TAGGED          |
| GREENSPOTTED       | 28           |                 |
| GREENSTRIPED       | 3            |                 |
| LINGCOD            | 2            |                 |
| ROSY               | 10           |                 |
| STARRY             | 3            |                 |
| YELLOWTAIL         | 2            |                 |
| <b>TOTAL</b>       | <b>56</b>    |                 |

**Table 1. Juvenile Rockfish Catches by Sweep During the Cruise**

| <b>Species (common name)</b> | <b>Sweep 1</b> | <b>Sweep 2</b> | <b>Sweep 3</b> | <b>Total</b> |
|------------------------------|----------------|----------------|----------------|--------------|
| Sebastes auriculatus (brown) | 14             | 29             | 15             | 58           |
| S. crameri (darkblotched)    | 4              |                | 2              | 6            |
| S. entomelus (widow)         | 251            | 541            | 66             | 858          |
| S. flavidus (yellowtail)     | 29             | 21             | 8              | 58           |
| S. goodei (chilipepper)      | 133            | 119            | 34             | 286          |
| S. hopkinsi (squarespot)     | 5              | 9              | 2              | 16           |
| S. jordani (shortbelly)      | 563            | 382            | 50             | 995          |
| S. levis (cowcod)            | 2              |                |                | 2            |
| S. melanops (black)          | 16             | 12             | 1              | 29           |
| S. mystinus (blue)           | 169            | 151            | 21             | 341          |
| S. paucispinus (bacaccio)    | 42             | 19             | 10             | 71           |
| S. pinniger                  | 100            | 152            | 6              | 258          |
| S. rufus (bank)              |                | 3              |                | 3            |
| S. saxicola (stripetail)     | 175            | 148            | 29             | 352          |
| S. semicinctus (halfbanded)  | 3              | 4              |                | 7            |
| S. serranoides (olive)       | 1              | 2              | 2              | 5            |
| S. wilsoni (pygmy)           |                | 2              |                | 2            |
| S. zacentrus (sharpchin)     | 2              | 2              | 1              | 5            |
| S. caurinus complex (copper) | 17             | 16             | 4              | 37           |
| Sebastes spp unknown         | 3              |                |                | 3            |
| Sebastomus spp               |                | 1              | 1              | 2            |
| <b>Grand Totals</b>          | <b>1529</b>    | <b>1613</b>    | <b>252</b>     | <b>3394</b>  |

**Table 2. Number of Pelagic Young-of-the-Year Rockfish Collected by Midwater Trawl at Standard Stations During May-June Cruises (1986-2002).**

| <b>SPECIES</b> | <b>86</b>    | <b>87</b>   | <b>88</b>     | <b>89</b>   | <b>90</b>   | <b>91</b>   | <b>92</b>   | <b>93</b>   | <b>94</b>   | <b>95</b>  | <b>96</b>   | <b>97</b>   | <b>98</b>  | <b>99</b>  | <b>00</b>   | <b>01</b>   | <b>02</b>   |
|----------------|--------------|-------------|---------------|-------------|-------------|-------------|-------------|-------------|-------------|------------|-------------|-------------|------------|------------|-------------|-------------|-------------|
| Shortbelly     | 9104         | 6865        | 107962        | 1598        | 4479        | 2422        | 2838        | 2287        | 949         | 276        | 1848        | 784         | 69         | 124        | 2016        | 3403        | 995         |
| Chilipepper    | 54           | 586         | 4418          | 24          | 66          | 343         | 90          | 1251        | 3           | 32         | 17          | 12          | 3          | 27         | 27          | 126         | 286         |
| Brown          | 470          | 10          | -             | 3           | 19          | 265         | 7           | 1226        | 15          | 5          | 32          | 2           | -          | 2          | 5           | 117         | 58          |
| Widow          | 11           | 424         | 257           | 13          | 296         | 623         | 1           | 101         | 24          | 25         | -           | 49          | 1          | 81         | 80          | 193         | 858         |
| Squarespot     | 4            | 177         | 380           | 16          | 649         | 47          | 70          | 25          | 2           | -          | -           | 1           | -          | -          | -           | 36          | 16          |
| Canary         | 46           | 71          | 162           | 39          | 23          | 618         | -           | 14          | 3           | -          | -           | 3           | -          | 38         | 9           | 31          | 258         |
| Blue           | 4            | 196         | 366           | 63          | 38          | 220         | 3           | 38          | 11          | 7          | 4           | 5           | -          | 9          | 10          | 67          | 341         |
| Stripetail     | 2            | 194         | 30            | 6           | 22          | 175         | 5           | 315         | 9           | 6          | 2           | 27          | 14         | 31         | 11          | 185         | 352         |
| Bocaccio       | 327          | 106         | 60            | 22          | 44          | 114         | 5           | 26          | 4           | 3          | 1           | 7           | 1          | 15         | 24          | 51          | 71          |
| Yellowtail     | 22           | 85          | 69            | 31          | 27          | 281         | 5           | 31          | 8           | 27         | 3           | 6           | 6          | 1          | 10          | 30          | 58          |
| Copper complex | 9            | 9           | 1             | -           | 1           | 15          | 116         | 82          | 54          | 7          | 10          | 42          | 4          | 2          | 4           | 25          | 5           |
| Halfbanded     | 1            | 9           | -             | 2           | 77          | 8           | 1           | 5           | 2           | -          | 6           | 68          | -          | 1          | -           | 96          | 7           |
| Pygmy          | 2            | 15          | 9             | 12          | 10          | 62          | 8           | 2           | 3           | -          | 1           | 2           | -          | 1          | 3           | 34          | 37          |
| Black          | 1            | 22          | 19            | 5           | 4           | 34          | -           | 6           | 2           | 7          | 7           | -           | 1          | 5          | 1           | 2           | 29          |
| Olive          | -            | 4           | 2             | 6           | 18          | -           | -           | 6           | 1           | -          | -           | -           | -          | -          | -           | 13          | 5           |
| Darkblotched   | -            | 7           | 5             | -           | 1           | 9           | -           | 9           | -           | 2          | -           | -           | -          | 2          | 1           | 1           | 6           |
| Cowcod         | 1            | 17          | 1             | 1           | -           | -           | 5           | 5           | -           | -          | -           | -           | -          | -          | -           | -           | 2           |
| Bank           | -            | 18          | 4             | -           | -           | -           | -           | 5           | -           | -          | -           | -           | -          | -          | 1           | 1           | 3           |
| Sebastomus     | 2            | 7           | 3             | -           | 1           | 3           | 8           | -           | -           | 1          | 2           | 27          | -          | -          | 2           | 2           | 2           |
| Splitnose      | 1            | 4           | -             | -           | 1           | -           | 19          | -           | -           | -          | -           | 10          | -          | 1          | 3           | -           | -           |
| Puget Sound    | -            | -           | -             | -           | -           | 18          | -           | -           | -           | -          | -           | -           | -          | -          | -           | -           | -           |
| Sharpchin      | -            | -           | -             | -           | -           | -           | 2           | -           | 14          | -          | -           | -           | -          | 1          | -           | 1           | 3           |
| Grass          | 1            | 1           | -             | -           | -           | -           | 8           | 2           | 1           | -          | -           | -           | 2          | -          | -           | 3           | -           |
| Quillback      | 2            | 1           | -             | -           | -           | 6           | -           | -           | 2           | -          | 1           | -           | -          | -          | -           | -           | -           |
| Vermillion     | -            | 4           | -             | -           | 1           | 1           | -           | -           | -           | -          | -           | -           | -          | -          | -           | -           | -           |
| Copper         | -            | -           | -             | -           | -           | -           | 1           | -           | -           | -          | 6           | -           | -          | -          | -           | -           | -           |
| Greenspotted   | -            | -           | -             | -           | -           | -           | 1           | -           | -           | -          | -           | -           | -          | -          | -           | -           | -           |
| Aurora         | -            | -           | -             | -           | -           | -           | -           | -           | -           | -          | -           | 1           | -          | -          | -           | -           | -           |
| Unknown        | 40           | 5           | -             | -           | 2           | 4           | 49          | 31          | 13          | 13         | 31          | 49          | 14         | 25         | 29          | 55          | 2           |
| <b>Totals</b>  | <b>10104</b> | <b>8837</b> | <b>113748</b> | <b>1841</b> | <b>5779</b> | <b>5290</b> | <b>3242</b> | <b>5467</b> | <b>1120</b> | <b>411</b> | <b>1971</b> | <b>1095</b> | <b>115</b> | <b>366</b> | <b>2236</b> | <b>4472</b> | <b>3394</b> |